



# SEQUENCE LISTING

<110> Hoechst Schering AgrEvo GmbH  
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<120> NUCLEIC ACID MOLECULES WHICH CODE FOR ENZYMES DERIVED FROM WHEAT AND WHICH ARE INVOLVED IN THE SYNTHESIS OF STARCH

<130> 514413-3849.1

<150> WO 99/58690

<151> 1999-11-18

<150> DE 198 20 608.9

<151> 1998-05-08

<150> 09/674,817

<151> 2000-11-06

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<170> PatentIn version 3.1

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| agg tac gcg ctc ggc ggc gcg tgc agg gtg ctc gcc gga atg ccc gcg<br>Arg Tyr Ala Leu Gly Gly Ala Cys Arg Val Leu Ala Gly Met Pro Ala<br>50 55 60        | 191 |
| ccg ctg ggc gcc acc gcg ctc gcc ggc ggg gtc aat ttc gcc gtc tat<br>Pro Leu Gly Ala Thr Ala Leu Ala Gly Gly Val Asn Phe Ala Val Tyr<br>65 70 75        | 239 |
| tcc ggc gga gcc acc gcc gcg gcg ctc tgc ctc ttc acg cca gaa gat<br>Ser Gly Gly Ala Thr Ala Ala Ala Leu Cys Leu Phe Thr Pro Glu Asp<br>80 85 90 95     | 287 |
| ctc aag gcg gtgggggttgc ctcccgagta gagttcatca gctttgcgtg<br>Leu Lys Ala   | 336 |
| cgccgcgcgc ccctttttttg ggcctgcaat ttaagttttg tactggggca aatgctgcag  | 396 |
| gat agg gtg acc gag gag gtt ccc ctt gac ccc ctg atg aat cgg acc<br>Asp Arg Val Thr Glu Glu Val Pro Leu Asp Pro Leu Met Asn Arg Thr<br>100 105 110     | 444 |
| ggg aac gtg tgg cat gtc ttc atc gaa ggc gag ctg cac aac atg ctt<br>Gly Asn Val Trp His Val Phe Ile Glu Gly Glu Leu His Asn Met Leu<br>115 120 125 130 | 492 |
| tac ggg tac agg ttc gac ggc acc ttt gct cct cac tgc ggg cac tac<br>Tyr Gly Tyr Arg Phe Asp Gly Thr Phe Ala Pro His Cys Gly His Tyr<br>135 140 145     | 540 |
| ctt gat gtt tcc aat gtc gtg gtg gat cct tat gct aag gca gtg ata<br>Leu Asp Val Ser Asn Val Val Val Asp Pro Tyr Ala Lys Ala Val Ile<br>150 155 160     | 588 |
| agc cga ggg gag tat ggt gtt cca gcg cgt ggt aac aat tgc tgg cct<br>Ser Arg Gly Glu Tyr Gly Val Pro Ala Arg Gly Asn Asn Cys Trp Pro<br>165 170 175     | 636 |
| cag atg gct ggc atg atc cct ctt cca tat agc acg ttt gat tgg gaa<br>Gln Met Ala Gly Met Ile Pro Leu Pro Tyr Ser Thr Phe Asp Trp Glu<br>180 185 190     | 684 |
| ggc gac cta cct cta aga tat cct caa aag gac ctg gta ata tat gag<br>Gly Asp Leu Pro Leu Arg Tyr Pro Gln Lys Asp Leu Val Ile Tyr Glu<br>195 200 205 210 | 732 |
| atg cac ttg cgt gga ttc acg aag cat gat tca agc aat gta gaa cat<br>Met His Leu Arg Gly Phe Thr Lys His Asp Ser Ser Asn Val Glu His<br>215 220 225     | 780 |
| ccg ggt act ttc att gga gct gtg tcg aag ctt gac tat ttg aag gag<br>Pro Gly Thr Phe Ile Gly Ala Val Ser Lys Leu Asp Tyr Leu Lys Glu<br>230 235 240     | 828 |

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| Leu Gly Val Asn Cys Ile Glu Leu Met Pro Cys His Glu Phe Asn Glu |      |
| 245 250 255   |      |
| ctg gag tac tca acc tct tct tcc aag atg aac ttt tgg gga tat tct | 924  |
| Leu Glu Tyr Ser Thr Ser Ser Ser Lys Met Asn Phe Trp Gly Tyr Ser |      |
| 260 265 270   |      |
| acc ata aac ttc ttt tca cca atg aca aga tac aca tca ggc ggg ata | 972  |
| Thr Ile Asn Phe Phe Ser Pro Met Thr Arg Tyr Thr Ser Gly Gly Ile |      |
| 275 280 285 290   |      |
| aaa aac tgt ggg cgt gat gcc ata aat gag ttc aaa act ttt gta aga | 1020 |
| Lys Asn Cys Gly Arg Asp Ala Ile Asn Glu Phe Lys Thr Phe Val Arg |      |
| 295 300 305   |      |
| gag gct cac aaa cgg gga att gag gtg atc ctg gat gtt gtc ttc aac | 1068 |
| Glu Ala His Lys Arg Gly Ile Glu Val Ile Leu Asp Val Val Phe Asn |      |
| 310 315 320   |      |
| cat aca gct gag ggt aat gag aat ggt cca ata tta tca ttt aag ggg | 1116 |
| His Thr Ala Glu Gly Asn Glu Asn Gly Pro Ile Leu Ser Phe Lys Gly |      |
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| gtc gat aat act aca tac tat atg ctt gca ccc aag gga gag ttt tat | 1164 |
| Val Asp Asn Thr Thr Tyr Tyr Met Leu Ala Pro Lys Gly Glu Phe Tyr |      |
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| aac tat tct ggc tgt ggg aat acc ttc aac tgt aat cat cct gtg gtt | 1212 |
| Asn Tyr Ser Gly Cys Gly Asn Thr Phe Asn Cys Asn His Pro Val Val |      |
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| cgt caa ttc att gta gat tgt tta aga tac tgg gtg acg gaa atg cat | 1260 |
| Arg Gln Phe Ile Val Asp Cys Leu Arg Tyr Trp Val Thr Glu Met His |      |
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| gtt gat ggt ttt cgt ttt gat ctt gca tcc ata atg acc aga ggt tcc | 1308 |
| Val Asp Gly Phe Arg Phe Asp Leu Ala Ser Ile Met Thr Arg Gly Ser |      |
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| Ser Leu Trp Asp Pro Val Asn Val Tyr Gly Ala Pro Ile Glu Gly Asp |      |
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| atg atc aca aca ggg aca cct ctt gtt act cca cca ctt att gac atg | 1404 |
| Met Ile Thr Thr Gly Thr Pro Leu Val Thr Pro Pro Leu Ile Asp Met |      |
| 420 425 430   |      |
| atc agc aat gac cca att ctt gga ggc gtc aag ctc att gct gaa gca | 1452 |
| Ile Ser Asn Asp Pro Ile Leu Gly Gly Val Lys Leu Ile Ala Glu Ala |      |
| 435 440 445 450   |      |
| tgg gat gca gga ggc ctc tat caa gta ggt caa ttc cct cac tgg aat | 1500 |
| Trp Asp Ala Gly Gly Leu Tyr Gln Val Gly Gln Phe Pro His Trp Asn |      |
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| 470 475 480  |      |
| att aaa ggc act gat gga ttt gct ggt ggt ttt gcc gaa tgt ctt tgt    | 1596 |
| Ile Lys Gly Thr Asp Gly Phe Ala Gly Gly Phe Ala Glu Cys Leu Cys    |      |
| 485 490 495  |      |
| gga agt cca cac cta tac cag gtaagttgtg gcaatacttg taaatgagtt       | 1647 |
| Gly Ser Pro His Leu Tyr Gln  |      |
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| gagtgaatgt cacctggatt ttttatatat accacatgat gatacacatc taaatatata  | 1707 |
| acaatcatag tgtatgcata tgcatttggc taagaagtat tagtgtatac actagtgcta  | 1767 |
| tatataggtt ttaacaccca acttgccaat gaaggaacat agggctttct agttatctta  | 1827 |
| tttatttgtc cgggtgaataa tccactgaaa aattccagcc atgtcatttt ttaggggggg | 1887 |
| agaagaaact atattgattt gccccctaa aagaagccat ctcagaattc ataggtaagt   | 1947 |
| tgcttttctg taaagaaagg aaaacgactt catactttct atcgggtgcta acttagctcg | 2007 |
| atgtatatatt gtaagatgaa tgccaaattt aatttgtcgg ataatttgat ctgttattca | 2067 |
| caaatttcta tttggtttct ctagaaatca aaccagtaac ttgttattgg cactgcaact  | 2127 |
| tcttattgat taatcag gca gga gga agg aaa cct tgg cac agt atc aac     | 2177 |
| Ala Gly Gly Arg Lys Pro Trp His Ser Ile Asn                        |      |
| 510 515  |      |
| ttt gta tgt gca cat gat gga ttt aca ctg gct gat ttg gta aca tat    | 2225 |
| Phe Val Cys Ala His Asp Gly Phe Thr Leu Ala Asp Leu Val Thr Tyr    |      |
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| aat aag aag tac aat tta cca aat ggg gag aac aac aga gat gga gaa    | 2273 |
| Asn Lys Lys Tyr Asn Leu Pro Asn Gly Glu Asn Asn Arg Asp Gly Glu    |      |
| 535 540 545  |      |
| aat cac aat ctt agc tgg aat tgt ggg gag gaa gga gaa ttc gca aga    | 2321 |
| Asn His Asn Leu Ser Trp Asn Cys Gly Glu Glu Gly Glu Phe Ala Arg    |      |
| 550 555 560  |      |
| ttg tct gtc aaa aga ttg agg aag agg cag atg cgc aat ttc ttt gtt    | 2369 |
| Leu Ser Val Lys Arg Leu Arg Lys Arg Gln Met Arg Asn Phe Phe Val    |      |
| 565 570 575 580  |      |
| tgt ctc atg gtt tct caa gga gtt cca atg ttc tac atg ggt gat gaa    | 2417 |
| Cys Leu Met Val Ser Gln Gly Val Pro Met Phe Tyr Met Gly Asp Glu    |      |
| 585 590 595  |      |
| tat ggc cac aca aaa ggg ggc aac aac aat aca tac tgc cat gat tct    | 2465 |
| Tyr Gly His Thr Lys Gly Gly Asn Asn Asn Thr Tyr Cys His Asp Ser    |      |
| 600 605 610  |      |
| tat gtc aat tat ttt cgc tgg gat aaa aaa gaa caa tac tct gag ttg    | 2513 |

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|-----|-----|-----|-----|-----|------------|--------------|--------------|--------------|--------------|-----|-----|-----|-----|-----|-----|------|--|
| Tyr | Val | Asn | Tyr | Phe | Arg        | Trp          | Asp          | Lys          | Lys          | Glu | Gln | Tyr | Ser | Glu | Leu |      |  |
|     |     | 615 |     |     |            |              | 620          |              |              |     |     | 625 |     |     |     |      |  |
| cac | cga | ttc | tgc | tgc | ctc        | atg          | acc          | aaa          | ttc          | cgc | aag | gag | tgc | gag | ggt | 2561 |  |
| His | Arg | Phe | Cys | Cys | Leu        | Met          | Thr          | Lys          | Phe          | Arg | Lys | Glu | Cys | Glu | Gly |      |  |
|     |     | 630 |     |     |            | 635          |              |              |              |     | 640 |     |     |     |     |      |  |
| ctt | ggc | ctt | gag | gac | ttt        | cca          | acg          | gcc          | aaa          | cgg | ctg | cag | tgg | cat | ggt | 2609 |  |
| Leu | Gly | Leu | Glu | Asp | Phe        | Pro          | Thr          | Ala          | Lys          | Arg | Leu | Gln | Trp | His | Gly |      |  |
|     |     | 645 |     |     | 650        |              |              |              | 655          |     |     |     |     |     | 660 |      |  |
| cat | cag | cct | ggg | aag | cct        | gat          | tgg          | tct          | gag          | aat | agc | cga | ttc | gtt | gcc | 2657 |  |
| His | Gln | Pro | Gly | Lys | Pro        | Asp          | Trp          | Ser          | Glu          | Asn | Ser | Arg | Phe | Val | Ala |      |  |
|     |     |     | 665 |     |            |              |              | 670          |              |     |     |     |     | 675 |     |      |  |
| ttt | tcc | atg | aaa | gat | gaa        | aga          | cag          | ggc          | gag          | atc | tat | gtg | gcc | ttc | aac | 2705 |  |
| Phe | Ser | Met | Lys | Asp | Glu        | Arg          | Gln          | Gly          | Glu          | Ile | Tyr | Val | Ala | Phe | Asn |      |  |
|     |     |     | 680 |     |            |              | 685          |              |              |     |     |     | 690 |     |     |      |  |
| acc | agc | cac | tta | ccg | gcc        | gtt          | gtt          | gag          | ctc          | cca | gag | cgc | gca | ggg | cgc | 2753 |  |
| Thr | Ser | His | Leu | Pro | Ala        | Val          | Val          | Glu          | Leu          | Pro | Glu | Arg | Ala | Gly | Arg |      |  |
|     |     | 695 |     |     |            | 700          |              |              |              |     | 705 |     |     |     |     |      |  |
| cgg | tgg | gaa | ccg | gtg | gtg        | gac          | aca          | ggc          | aag          | cca | gca | cca | tac | gac | ttc | 2801 |  |
| Arg | Trp | Glu | Pro | Val | Val        | Asp          | Thr          | Gly          | Lys          | Pro | Ala | Pro | Tyr | Asp | Phe |      |  |
|     |     | 710 |     |     | 715        |              |              |              |              | 720 |     |     |     |     |     |      |  |
| ctc | acc | gac | gac | tta | cct        | gat          | cgc          | gct          | ctc          | acc | ata | cac | cag | ttc | tcg | 2849 |  |
| Leu | Thr | Asp | Asp | Leu | Pro        | Asp          | Arg          | Ala          | Leu          | Thr | Ile | His | Gln | Phe | Ser |      |  |
|     |     | 725 |     |     | 730        |              |              |              | 735          |     |     |     |     |     | 740 |      |  |
| cat | ttc | ctc | tac | tcc | aac        | ctc          | tac          | ccc          | atg          | ctc | agc | tac | tca | tcg | gtc | 2897 |  |
| His | Phe | Leu | Tyr | Ser | Asn        | Leu          | Tyr          | Pro          | Met          | Leu | Ser | Tyr | Ser | Ser | Val |      |  |
|     |     |     | 745 |     |            |              |              | 750          |              |     |     |     | 755 |     |     |      |  |
| atc | cta | gta | ttg | cgc | cct        | gat          | gtt          | tga          | gag          | acc | aat | ata | tac | agt | aaa | 2945 |  |
| Ile | Leu | Val | Leu | Arg | Pro        | Asp          | Val          |              | Glu          | Thr | Asn | Ile | Tyr | Ser | Lys |      |  |
|     |     |     | 760 |     |            |              |              | 765          |              |     |     |     | 770 |     |     |      |  |
| taa | tat | gtc | tat | atg | taaaaaaaaa | aaaaaaaaaaaa | aaaaaaaaaaaa | aaaaaaaaaaaa | aaaaaaaaaaaa |     |     |     |     |     |     | 2997 |  |
|     | Tyr | Val | Tyr | Met |            |              |              |              |              |     |     |     |     |     |     |      |  |
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| aggacgagcc  | ggtggcggag gacaggtacg cgctcggcgg cgcggtgcagg gtgctcgccg 180 |
| gaatgcccgc  | gccgctgggc gccaccgcgc tcgccggcgg ggtcaatttc gccgtctatt 240  |

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| ccggcggagc caccgccgcg gcgctctgcc tcttcacgcc agaagatctc aaggcgggtgg | 300  |
| ggttgcctcc cgagtagagt tcatcagctt tgcgtgcgcc gcgcgcccct tttttgggcc  | 360  |
| tgcaatttaa gttttgtact ggggcaaagt ctgcaggata gggtgaccga ggaggttccc  | 420  |
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| cacaacatgc ttacgggta caggttcgac ggcacctttg ctctcactg cgggcactac    | 540  |
| cttgatgttt ccaatgtcgt ggtggatcct tatgctaagg cagtgataag ccgaggggag  | 600  |
| tatggtgttc cagcgcgtgg taacaattgc tggcctcaga tggctggcat gatccctctt  | 660  |
| ccatatagca cgtttgattg ggaaggcgac ctacctata gatatactca aaaggacctg   | 720  |
| gtaatatatg agatgcactt gcgtggattc acgaagcatg attcaagcaa tgtagaacat  | 780  |
| ccgggtactt tcattggagc tgtgtcgaag cttgactatt tgaaggagct tggagttaat  | 840  |
| tgtattgaat taatgccctg ccatgagttc aacgagctgg agtactcaac ctcttcttcc  | 900  |
| aagatgaact tttggggata ttctaccata aacttctttt caccaatgac aagatacaca  | 960  |
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Tyr Ala Leu Gly Gly Ala Cys Arg Val Leu Ala Gly Met Pro Ala Pro  
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 65 70 75 80  
 Gly Gly Ala Thr Ala Ala Ala Leu Cys Leu Phe Thr Pro Glu Asp Leu  
 85 90 95  
 Lys Ala Asp Arg Val Thr Glu Glu Val Pro Leu Asp Pro Leu Met Asn  
 100 105 110  
 Arg Thr Gly Asn Val Trp His Val Phe Ile Glu Gly Glu Leu His Asn  
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 Met Leu Tyr Gly Tyr Arg Phe Asp Gly Thr Phe Ala Pro His Cys Gly  
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 His Tyr Leu Asp Val Ser Asn Val Val Val Asp Pro Tyr Ala Lys Ala  
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 Val Ile Ser Arg Gly Glu Tyr Gly Val Pro Ala Arg Gly Asn Asn Cys  
 165 170 175  
 Trp Pro Gln Met Ala Gly Met Ile Pro Leu Pro Tyr Ser Thr Phe Asp  
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 195 200 205  
 Tyr Glu Met His Leu Arg Gly Phe Thr Lys His Asp Ser Ser Asn Val  
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 Glu His Pro Gly Thr Phe Ile Gly Ala Val Ser Lys Leu Asp Tyr Leu  
 225 230 235 240  
 Lys Glu Leu Gly Val Asn Cys Ile Glu Leu Met Pro Cys His Glu Phe  
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 Lys Gly Val Asp Asn Thr Thr Tyr Tyr Met Leu Ala Pro Lys Gly Glu  
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Arg Phe Val Ala Phe Ser Met Lys Asp Glu Arg Gln Gly Glu Ile Tyr  
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Val Ala Phe Asn Thr Ser His Leu Pro Ala Val Val Glu Leu Pro Glu  
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Arg Ala Gly Arg Arg Trp Glu Pro Val Val Asp Thr Gly Lys Pro Ala  
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Pro Tyr Asp Phe Leu Thr Asp Asp Leu Pro Asp Arg Ala Leu Thr Ile  
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15 20 25

99

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| gcg acg aag gcc gag gat gag ggg gag gag gac gag ccg gtg gcg gag<br>Ala Thr Lys Ala Glu Asp Glu Gly Glu Glu Asp Glu Pro Val Ala Glu<br>30 35 40        | 147 |
| gac agg tac gcg ctc ggc ggc gcg tgc agg gtg ctc gcc gga atg ccc<br>Asp Arg Tyr Ala Leu Gly Gly Ala Cys Arg Val Leu Ala Gly Met Pro<br>45 50 55 60     | 195 |
| acg ccg ctg ggc gcc acc gcg ctc gcc ggc ggg gtc aat ttc gcc gtc<br>Thr Pro Leu Gly Ala Thr Ala Leu Ala Gly Gly Val Asn Phe Ala Val<br>65 70 75        | 243 |
| tac tcc ggc gga gcc aca gcc gcg gcg ctc tgc ctc ttc acg cca gaa<br>Tyr Ser Gly Gly Ala Thr Ala Ala Ala Leu Cys Leu Phe Thr Pro Glu<br>80 85 90        | 291 |
| gat ctc aag gcg gat agg gtg acg gag gag gtt ccc ctt gac ccc ctg<br>Asp Leu Lys Ala Asp Arg Val Thr Glu Glu Val Pro Leu Asp Pro Leu<br>95 100 105      | 339 |
| atg aat cgg act ggg aac gta tgg cat gtc ttc atc gaa ggc gag ctg<br>Met Asn Arg Thr Gly Asn Val Trp His Val Phe Ile Glu Gly Glu Leu<br>110 115 120     | 387 |
| cag gac atg ctt tac ggg tac agg ttc gac ggc acc ttt gct cct cac<br>Gln Asp Met Leu Tyr Gly Tyr Arg Phe Asp Gly Thr Phe Ala Pro His<br>125 130 135 140 | 435 |
| tgc ggg cac tac ctt gat gtt tcc aat gtc gtg gtg gat cct tat gct<br>Cys Gly His Tyr Leu Asp Val Ser Asn Val Val Val Asp Pro Tyr Ala<br>145 150 155     | 483 |
| aag gca gtg ata agc cga ggg gag tat ggt gtt ccg gcg cgt ggt aac<br>Lys Ala Val Ile Ser Arg Gly Glu Tyr Gly Val Pro Ala Arg Gly Asn<br>160 165 170     | 531 |
| aat tgc tgg cct cag atg gct ggc atg atc cct ctt cca tat agc acg<br>Asn Cys Trp Pro Gln Met Ala Gly Met Ile Pro Leu Pro Tyr Ser Thr<br>175 180 185     | 579 |
| ttt gat tgg gaa ggc gac cta cct cta aga tat cct caa aag gac ctg<br>Phe Asp Trp Glu Gly Asp Leu Pro Leu Arg Tyr Pro Gln Lys Asp Leu<br>190 195 200     | 627 |
| gta ata tat gag atg cac ttg cgt gga ttc acg aag cat gat tca agc<br>Val Ile Tyr Glu Met His Leu Arg Gly Phe Thr Lys His Asp Ser Ser<br>205 210 215 220 | 675 |
| aat gta gaa cat ccc ggt act ttc att ggg gct gtg tcg aag ctt gac<br>Asn Val Glu His Pro Gly Thr Phe Ile Gly Ala Val Ser Lys Leu Asp<br>225 230 235     | 723 |
| tat ttg aag gag ctt gga gtt aat tgt att gag tta atg ccc tgc cat<br>Tyr Leu Lys Glu Leu Gly Val Asn Cys Ile Glu Leu Met Pro Cys His<br>240 245 250     | 771 |

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| gag ttc aac gag ctg gag tac tca acc tct tct tcc aag atg aac ttt | 819  |
| Glu Phe Asn Glu Leu Glu Tyr Ser Thr Ser Ser Ser Lys Met Asn Phe |      |
| 255 260 265   |      |
| tgg gga tat tct acc ata aac ttc ttt tca cca atg acg aga tac aca | 867  |
| Trp Gly Tyr Ser Thr Ile Asn Phe Phe Ser Pro Met Thr Arg Tyr Thr |      |
| 270 275 280   |      |
| tca ggc ggg ata aaa aac tgt ggg cgt gat gcc ata aat gag ttc aaa | 915  |
| Ser Gly Gly Ile Lys Asn Cys Gly Arg Asp Ala Ile Asn Glu Phe Lys |      |
| 285 290 295 300   |      |
| act ttt gta aga gag gct cac aaa cgg gga att gag gtg atc ctg gat | 963  |
| Thr Phe Val Arg Glu Ala His Lys Arg Gly Ile Glu Val Ile Leu Asp |      |
| 305 310 315   |      |
| gtt gtc ttc aac cat aca gct gag ggt aat gag aat ggt cca ata tta | 1011 |
| Val Val Phe Asn His Thr Ala Glu Gly Asn Glu Asn Gly Pro Ile Leu |      |
| 320 325 330   |      |
| tca ttt agg ggg gtc gat aat act aca tac tat atg ctt gca ccc aag | 1059 |
| Ser Phe Arg Gly Val Asp Asn Thr Thr Tyr Tyr Met Leu Ala Pro Lys |      |
| 335 340 345   |      |
| gga gag ttt tat aac tat tct ggc tgt ggg aat acc ttc aac tgt aat | 1107 |
| Gly Glu Phe Tyr Asn Tyr Ser Gly Cys Gly Asn Thr Phe Asn Cys Asn |      |
| 350 355 360   |      |
| cat cct gtg gtt cgt caa ttc att gta gat tgt tta aga tac tgg gtg | 1155 |
| His Pro Val Val Arg Gln Phe Ile Val Asp Cys Leu Arg Tyr Trp Val |      |
| 365 370 375 380   |      |
| acg gaa atg cat gtt gat ggt ttt cgt ttt gat ctt gca tcc ata atg | 1203 |
| Thr Glu Met His Val Asp Gly Phe Arg Phe Asp Leu Ala Ser Ile Met |      |
| 385 390 395   |      |
| acc aga ggt tcc agt ctg tgg gat cca gtt aac gtg tat gga gct cca | 1251 |
| Thr Arg Gly Ser Ser Leu Trp Asp Pro Val Asn Val Tyr Gly Ala Pro |      |
| 400 405 410   |      |
| ata gaa ggt gac atg atc aca aca ggg aca cct ctt gtt act cca cca | 1299 |
| Ile Glu Gly Asp Met Ile Thr Thr Gly Thr Pro Leu Val Thr Pro Pro |      |
| 415 420 425   |      |
| ctt att gac atg atc agc aat gac cca att ctt gga ggc gtc aag ctc | 1347 |
| Leu Ile Asp Met Ile Ser Asn Asp Pro Ile Leu Gly Gly Val Lys Leu |      |
| 430 435 440   |      |
| gtt gct gaa gca tgg gat gca gga ggc ctc tat caa gta ggt caa ttc | 1395 |
| Val Ala Glu Ala Trp Asp Ala Gly Gly Leu Tyr Gln Val Gly Gln Phe |      |
| 445 450 455 460   |      |
| cct cac tgg aat gtt tgg tct gag tgg aat ggg aag tac cgg gac att | 1443 |
| Pro His Trp Asn Val Trp Ser Glu Trp Asn Gly Lys Tyr Arg Asp Ile |      |
| 465 470 475   |      |

|   |      |
|---|------|
| gtg cgt caa ttc att aaa ggc act gat gga ttt gct ggt ggt ttt gcc | 1491 |
| Val Arg Gln Phe Ile Lys Gly Thr Asp Gly Phe Ala Gly Gly Phe Ala |      |
| 480 485 490   |      |
| gaa tgt ctt tgt gga agt cca cac cta tac cag gca gga gga agg aaa | 1539 |
| Glu Cys Leu Cys Gly Ser Pro His Leu Tyr Gln Ala Gly Gly Arg Lys |      |
| 495 500 505   |      |
| cct tgg cac agt atc aac ttt gta tgt gca cac gat gga ttt aca ctg | 1587 |
| Pro Trp His Ser Ile Asn Phe Val Cys Ala His Asp Gly Phe Thr Leu |      |
| 510 515 520   |      |
| gct gat ttg gta aca tat aat aac aag tac aat tta cca aat ggg gag | 1635 |
| Ala Asp Leu Val Thr Tyr Asn Asn Lys Tyr Asn Leu Pro Asn Gly Glu |      |
| 525 530 535 540   |      |
| aac aac aga gat gga gaa aat cac aat ctt agc tgg aat tgt ggg gag | 1683 |
| Asn Asn Arg Asp Gly Glu Asn His Asn Leu Ser Trp Asn Cys Gly Glu |      |
| 545 550 555   |      |
| gaa gga gaa ttc gca aga ttg tct gtc aaa aga ttg agg aag agg cag | 1731 |
| Glu Gly Glu Phe Ala Arg Leu Ser Val Lys Arg Leu Arg Lys Arg Gln |      |
| 560 565 570   |      |
| atg cgc aat ttc ttt gtt tgt ctc atg gtt tct caa gga gtt cca atg | 1779 |
| Met Arg Asn Phe Phe Val Cys Leu Met Val Ser Gln Gly Val Pro Met |      |
| 575 580 585   |      |
| ttc tac atg ggt gat gaa tat ggc cac aca aaa ggg ggc aac aac aat | 1827 |
| Phe Tyr Met Gly Asp Glu Tyr Gly His Thr Lys Gly Gly Asn Asn Asn |      |
| 590 595 600   |      |
| aca tac tgc cat gat tct tat gtc aat tat ttt cgc tgg gat aaa aaa | 1875 |
| Thr Tyr Cys His Asp Ser Tyr Val Asn Tyr Phe Arg Trp Asp Lys Lys |      |
| 605 610 615 620   |      |
| gaa caa tac tct gac ttg cac cga ttc tgt tgc ctc atg acc aaa ttc | 1923 |
| Glu Gln Tyr Ser Asp Leu His Arg Phe Cys Cys Leu Met Thr Lys Phe |      |
| 625 630 635   |      |
| cgc aag gag tgc gag ggt ctt ggc ctt gag gat ttt cca acg gcc gaa | 1971 |
| Arg Lys Glu Cys Glu Gly Leu Gly Leu Glu Asp Phe Pro Thr Ala Glu |      |
| 640 645 650   |      |
| cgg ctg cag tgg cat ggt cat cag cct ggg aag cct gat tgg tct gag | 2019 |
| Arg Leu Gln Trp His Gly His Gln Pro Gly Lys Pro Asp Trp Ser Glu |      |
| 655 660 665   |      |
| aat agc cga ttc gtt gcc ttt tcc atg aaa gat gaa aga cag ggc gag | 2067 |
| Asn Ser Arg Phe Val Ala Phe Ser Met Lys Asp Glu Arg Gln Gly Glu |      |
| 670 675 680   |      |
| atc tat gtg gcc ttc aac acc agc cac tta ccg gcc gtt gtt gag ctc | 2115 |
| Ile Tyr Val Ala Phe Asn Thr Ser His Leu Pro Ala Val Val Glu Leu |      |
| 685 690 695 700   |      |

ccg gag cgc aca ggg cgc cgg tgg gaa ccg gtg gtg gac aca ggc aag 2163  
 Pro Glu Arg Thr Gly Arg Arg Trp Glu Pro Val Val Asp Thr Gly Lys  
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 cca gca cca tac gac ttc ctc act gac gac tta cct gat cgc gct ctc 2211  
 Pro Ala Pro Tyr Asp Phe Leu Thr Asp Asp Leu Pro Asp Arg Ala Leu  
 720 725 730  
  
 acc ata cac cag ttc tct cat ttc ctc aac tcc aac ctc tac ccc atg 2259  
 Thr Ile His Gln Phe Ser His Phe Leu Asn Ser Asn Leu Tyr Pro Met  
 735 740 745  
  
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 Leu Ser Tyr Ser Ser Val Ile Leu Val Leu Arg Pro Asp Val  
 750 755 760  
  
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 Leu Gly Gly Ala Cys Arg Val Leu Ala Gly Met Pro Thr Pro Leu Gly  
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 65 70 75 80  
  
 Ala Thr Ala Ala Ala Leu Cys Leu Phe Thr Pro Glu Asp Leu Lys Ala  
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 Asp Arg Val Thr Glu Glu Val Pro Leu Asp Pro Leu Met Asn Arg Thr  
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 Gly Asn Val Trp His Val Phe Ile Glu Gly Glu Leu Gln Asp Met Leu  
 115 120 125  
  
 Tyr Gly Tyr Arg Phe Asp Gly Thr Phe Ala Pro His Cys Gly His Tyr  
 130 135 140

Leu Asp Val Ser Asn Val Val Val Asp Pro Tyr Ala Lys Ala Val Ile  
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 Ser Arg Gly Glu Tyr Gly Val Pro Ala Arg Gly Asn Asn Cys Trp Pro  
 165 170 175  
 Gln Met Ala Gly Met Ile Pro Leu Pro Tyr Ser Thr Phe Asp Trp Glu  
 180 185 190  
 Gly Asp Leu Pro Leu Arg Tyr Pro Gln Lys Asp Leu Val Ile Tyr Glu  
 195 200 205  
 Met His Leu Arg Gly Phe Thr Lys His Asp Ser Ser Asn Val Glu His  
 210 215 220  
 Pro Gly Thr Phe Ile Gly Ala Val Ser Lys Leu Asp Tyr Leu Lys Glu  
 225 230 235 240  
 Leu Gly Val Asn Cys Ile Glu Leu Met Pro Cys His Glu Phe Asn Glu  
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 Leu Glu Tyr Ser Thr Ser Ser Ser Lys Met Asn Phe Trp Gly Tyr Ser  
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 Thr Ile Asn Phe Phe Ser Pro Met Thr Arg Tyr Thr Ser Gly Gly Ile  
 275 280 285  
 Lys Asn Cys Gly Arg Asp Ala Ile Asn Glu Phe Lys Thr Phe Val Arg  
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 Glu Ala His Lys Arg Gly Ile Glu Val Ile Leu Asp Val Val Phe Asn  
 305 310 315 320  
 His Thr Ala Glu Gly Asn Glu Asn Gly Pro Ile Leu Ser Phe Arg Gly  
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 Val Asp Asn Thr Thr Tyr Tyr Met Leu Ala Pro Lys Gly Glu Phe Tyr  
 340 345 350  
 Asn Tyr Ser Gly Cys Gly Asn Thr Phe Asn Cys Asn His Pro Val Val  
 355 360 365  
 Arg Gln Phe Ile Val Asp Cys Leu Arg Tyr Trp Val Thr Glu Met His  
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 Val Asp Gly Phe Arg Phe Asp Leu Ala Ser Ile Met Thr Arg Gly Ser  
 385 390 395 400  
 Ser Leu Trp Asp Pro Val Asn Val Tyr Gly Ala Pro Ile Glu Gly Asp  
 405 410 415  
 Met Ile Thr Thr Gly Thr Pro Leu Val Thr Pro Pro Leu Ile Asp Met  
 420 425 430  
 Ile Ser Asn Asp Pro Ile Leu Gly Gly Val Lys Leu Val Ala Glu Ala  
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Trp Asp Ala Gly Gly Leu Tyr Gln Val Gly Gln Phe Pro His Trp Asn  
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 Val Trp Ser Glu Trp Asn Gly Lys Tyr Arg Asp Ile Val Arg Gln Phe  
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 Ile Lys Gly Thr Asp Gly Phe Ala Gly Gly Phe Ala Glu Cys Leu Cys  
 485 490 495  
 Gly Ser Pro His Leu Tyr Gln Ala Gly Gly Arg Lys Pro Trp His Ser  
 500 505 510  
 Ile Asn Phe Val Cys Ala His Asp Gly Phe Thr Leu Ala Asp Leu Val  
 515 520 525  
 Thr Tyr Asn Asn Lys Tyr Asn Leu Pro Asn Gly Glu Asn Asn Arg Asp  
 530 535 540  
 Gly Glu Asn His Asn Leu Ser Trp Asn Cys Gly Glu Glu Gly Glu Phe  
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 Ala Arg Leu Ser Val Lys Arg Leu Arg Lys Arg Gln Met Arg Asn Phe  
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 Phe Val Cys Leu Met Val Ser Gln Gly Val Pro Met Phe Tyr Met Gly  
 580 585 590  
 Asp Glu Tyr Gly His Thr Lys Gly Gly Asn Asn Asn Thr Tyr Cys His  
 595 600 605  
 Asp Ser Tyr Val Asn Tyr Phe Arg Trp Asp Lys Lys Glu Gln Tyr Ser  
 610 615 620  
 Asp Leu His Arg Phe Cys Cys Leu Met Thr Lys Phe Arg Lys Glu Cys  
 625 630 635 640  
 Glu Gly Leu Gly Leu Glu Asp Phe Pro Thr Ala Glu Arg Leu Gln Trp  
 645 650 655  
 His Gly His Gln Pro Gly Lys Pro Asp Trp Ser Glu Asn Ser Arg Phe  
 660 665 670  
 Val Ala Phe Ser Met Lys Asp Glu Arg Gln Gly Glu Ile Tyr Val Ala  
 675 680 685  
 Phe Asn Thr Ser His Leu Pro Ala Val Val Glu Leu Pro Glu Arg Thr  
 690 695 700  
 Gly Arg Arg Trp Glu Pro Val Val Asp Thr Gly Lys Pro Ala Pro Tyr  
 705 710 715 720  
 Asp Phe Leu Thr Asp Asp Leu Pro Asp Arg Ala Leu Thr Ile His Gln  
 725 730 735  
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